

# Calculating and Placing Non-Residential Receptors (NRRs)

## Methodology: Usage

FHWA-HEP-17-059

This Fact Sheet is intended to provide basic information regarding the calculation (Step 1) and placement (Step 2) of Non-Residential Receptors (NRRs) using the Usage-based Methodology.

1. How many Receptors will I have?
2. Where would I then place those receptors within a site?
3. What impact do these decisions have on the Feasibility and Reasonableness of Noise Abatement?

### LEGEND



One star =  
One receptor

This methodology is the most time consuming and requires extensive information collection. When site-specific data is unavailable, reasonable input values may be obtained from internet research.

**For this methodology, NRR Values are calculated using an equation:**

Average persons per household = X

*(Potential Source: Quick Facts from the US Census Bureau)*

Hours per day used by average household occupant = Y sleeping + Z other activities

*(Potential Source: Bureau of Labor Statistics)*

Person hours per day = (X)(Z) = Q

Person hours per year = (Q)(365) = Value A

Number of days in the year the site is available for use = N

Number of hours per day the site is available for use = H

Typical number of people per day using the site = P

NRR Value = (N)(H)(P)/Value A

**Note:** The second portion of this generic formula will vary based on the State Highway Agency's policy or guidance, and on the type of the location.

The person-hours-per year of use for a non-residential land use (Value A) is compared to the available person-hours-per-year of use of a typical residential unit (Value B). Value B is always equal to one (one receptor).

The person-hours-per-year of a residential unit are based on interior and exterior activities and assume that a residential dwelling unit is available for use 24 hours per day. External use would occur during all hours except when sleeping, 8-10 hours of the day.

**In this usage-based method, NRR points is usually placed within the parcel using one of the following options:**

- 1) At the center of each identified land use.
- 2) A point closest to the noise source.
- 3) By distributing the points within the land use, similar to other NRR Methods.
- 4) Based on the activity-specific magnitude of the NRR value and the size of the land use.

*The contents of this fact sheet are meant for informational purposes only and shall not be considered FHWA policy, guidance and/or requirements. This fact sheet is partially based on State noise policies as of October 2011, updates to those policies since then may not be reflected here. Aerial photographs courtesy Google Earth.*

## CASE STUDY EXAMPLES



U.S. Department of Transportation  
Federal Highway Administration

No actual data on the sites was obtained, the examples assume:

That all properties were impacted.

A value of 14,000 person-hours per year value and maximum capacity usage of facilities.

The West Parcel consists of 9 activity areas; the East Parcel consists of 5 activity areas. All areas are open 12 hours a day for 365 days a year, except the pool, which is available only for 120 days out of the year.

The West parcel has 279,175 person-hours per year of usage, while the East parcel has 124,161 person-hours/year.



West Parcel NRR Value = 19.9  
East Parcel NRR Value = 8.9  
Total facility NRR Value = 28.8 (rounded to 29)

20 NRR Points are placed equally throughout the activity areas on the West parcel, and 9 NRR Points are placed equally throughout activity areas in the East parcel.

A 4,000 foot portion of a multi-mile trail parallels a major highway. There are 5 rest areas spaced evenly throughout.

The average user is on this section for 10 minutes, and 50 people per hour use the trail. The trail is typically available for use 12 hours per day year round.

There are 37,230 person-hours/year of usage.



NRR Value = 2.7 (rounded to 3)

NRR Points placed at 3 rest areas throughout the trail.

A worship center conducts 1 service on Saturday night (50 people), and 3 services (100 people each) plus a Sunday school (70 people) on Sunday morning. All activities are 1 hour in duration.

It is also used weekdays for a 4-hour day-care (60 people) and 6 nights a week by social groups (25 people each night, 2 hours each night).

This results in 99,840 person-hours/year.



NRR Value = 7.1 (rounded to 8)

NRR Points are placed within the building in areas corresponding to the rooms being used for each activity.

A 400-unit motel has an occupancy rate of 65%, and an average of 1.5 people/room. It has an exterior area that is available to all occupants year round. It is estimated that  $\frac{1}{2}$  of guests use this outdoor area for a period of 2 hours.

This results in 142,350 person-hours/year.



NRR Value = 10.2 (rounded to 11)

NRR Points evenly spaced throughout the activity areas (pool, sunbathing area, restaurant, gazebo).

An apartment complex has an outdoor swimming pool and pool deck area. It has a capacity of 150 people and is available for use on 110 days per year for 10 hours per day. It is estimated that, on average, the facility operates at 30 percent of capacity.

This results in 49,500 person-hours/year.



NRR Value = 3.5 (rounded to 4)

NRR Points are placed in a line along the side of the pool area facing the noise source.